COMPETITIVE TRAIT ANXIETY, SUCCESS-FAILURE AND SEX AS DETERMINANTS OF MOTOR PERFORMANCE[1]

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Abstract:

Summary.—Two experiments determined the effects of competitive trait anxiety, success-failure, and sex on the performance of 10- to 12-yr.-old children anxiety, success-failure, and sex on the performance of 10- to 12-yr.-old children competing on a complex motor maze. Competitive trait anxiety was assessed by the Sport Competition Anxiety Test and success-failure was induced by giving bogus win-loss feedback. High and low competitive trait-anxiety children were randomly assigned to one of three conditions: winning 80%, 50% or 20% of 20 contests. The average completion time and the variability of times within each of two blocks of 10 contests were the two performance measures. State-anxiety was assessed with Spielberger's State Anxiety inventory for Children as an indicant of arousal prior to and during competition. The findings of Exp. 1 yielded no significant performance differences. In Exp. 2 a significant interaction of competitive trait anxiety X success-failure X sex for performance time and variability was obtained. This interaction was largely attributed to sex differences.

Article:

Over the past 25 years researchers have failed to find any consistent relationship between trait anxiety (A-trait) and motor performance (Martens, 1971, 1974). One explanation for the inconsistent findings among this voluminous research is that generalized traits are not good predictors of behavior. In point of fact, Sarason, Davidson, Lighthall, Waite, and Ruebush (1960) and Watson and Friend (1969) found that scales measuring situation-specific A- traits were better predictors of behavior than generalized A-trait scales. The purpose of this study was to determine if a sport-specific competitive A-trait scale is a better predictor of motor performance among subjects who are competing. The recent development of the Sport Competition Anxiety Test (Martens, in press), designed to measure the tendency for persons to manifest varying levels of state anxiety (A-state) in competitive sport situations, provides the needed instrumentation for investigating this problem.

The situation-specific A-trait approach is based on the assumption that most people do not manifest elevated A-state levels in all situations but only in certain types of situations. In other words, high competitive A-trait persons are expected to manifest higher levels of A-state than low competitive A-trait persons in competitive situations but not necessarily in other situations. These higher levels of A-state manifested by high competitive A-trait persons in competitive situations are expected to affect performance. Based on drive theory, if a complex task is novel or unlearned, higher A-states are expected to interfere with task execution during the initial stages of performance. The task used in this study, known as the motor maze, was a novel and complex task requiring speed, accuracy, and anticipatory timing. Thus, it was hypothesized that high competitive A-trait subjects perform more poorly than low competitive A-trait persons in a competitive situation, but no differences between high and low competitive A-trait persons were expected in a noncompetitive situation.

To test this hypothesis adequately two experimental procedures were essential: (a) to place both high and low competitive A-trait persons in a competitive situation and (b) to measure A-state levels in the competitive

[1] Data for these experiments were collected when all three authors were members of the Motor and Leisure Behavior Research Laboratory, Children's Research Center, University of Illinois, Champaign.

situation. These procedures were incorporated into two experiments which examined the relationship between A-trait, A-state, and motor performance. Because this report summarizes only one segment of a larger research project, the specifics of the A-state data analyses and results are not presented here. These results, reported in Scanlan (1975) for Exp. 1 and in Martens and Gill (in press) for Exp. 2, will be discussed when they assist in understanding the hypotheses and performance results.

The procedures in the two experiments reported here required all subjects to compete in 20 games with a simulated opponent using the complex motor maze task. By investigating performance over a series of trials it was possible to vary the win-loss ratio when competing by manipulating the performance feedback. Three win-loss ratios were manipulated through bogus feedback to determine the influence of success-failure on motor performance. In Exp. 1 these three conditions were: win 80% of the contests (W_{80}), win 50% of the contests (W_{50}), and win 20% of the contests (W_{20}). In Exp. 2 these three win-loss ratios were also compared with a noncompetitive situation.

The predictions about the influence of the three win-loss conditions on performance are also derived from drive theory. It was hypothesized that those persons manifesting lower levels of A-state in response to the competitive situation perform better. In Exps. 1 and 2 A-state levels significantly increased as the number of contests lost increased. Moreover, in Exp. 2 subjects in the W_{80} condition manifested low A-state levels similar to subjects in the noncompetitive condition. Based on these results, subjects in the W_{80} and noncompetitive conditions were hypothesized to perform better than those in the W_{50} condition, and subjects in the W_{50} condition were expected to perform better than subjects in the W_{20} condition. Finally, because the influence of the win-loss treatments should increase with each additional contest, it was hypothesized that this treatment would have greater effects on performance in the later contests than in early ones.

The final comparison of interest is the possible interaction of competitive A-trait and success-failure. In general high competitive A-trait subjects should manifest higher levels of A-state than low competitive A-trait subjects and subjects who perceive they are failing should manifest higher levels of A-state than subjects who perceive they are succeeding. Low competitive A-trait subjects' A-state levels may, however, be less affected by the manipulation of success and failure than high competitive A-trait subjects. Previous research (e.g., McAdoo, 1970) with general A-trait and success-failure has shown that success reduced the A-state difference between high and low A-trait persons and failure magnified the difference. Thus it was predicted that high competitive A-trait subjects who fail perform poorer than high competitive A-trait subjects who succeed, but the difference between the performances of the low competitive A-trait groups is expected to be less than the difference between the high competitive A-trait groups.

EXPERIMENT 1

Method

Subjects and design.—Approximately 6 wk. prior to the actual experiment the Sport Competition Anxiety Test was administered to 306 fifth and sixth grade boys. From this initial sample, 42 high scoring boys who scored in the upper quartile (21-30) and 42 low scoring boys who scored in the lower quartile (10-14) were selected for the experiment and equal numbers of high and low scoring subjects were randomly assigned to the following three success-failure conditions: (a) win 80% of the contests (W_{80}), (b) win 50% of the contests (W_{80}), and (c) win 20% of the contests (W_{80}). Performance times for the 20 trials were grouped into two blocks of 10 trials each for analysis yielding a 2 X 3 X 2 (sports anxiety X success-failure analysis yielding a 2 X 3 X 2 (sports anxiety X success-failure X blocks of trials) repeated-measures factorial design.

Apparatus—The experimental apparatus, which is described in greater detail elsewhere (Scanlan, 1975), was located in a mobile van that was driven to the schools for testing. An aluminum maze mounted on a two-dimensional teeter-board with two handles for the subject to manipulate to tilt the board and move a steel ball through the maze provided the motor cask. Competition was simulated with a pseudo-computer that purportedly connected the individual with an opponent who was at another school in a similar van. A display panel located above the maze indicated both the subject's and opponents progress through their respective mazes during each contest, although the opponent's progress was, in fact, controlled by the experimenter from a master console.

Procedure.—Each subject was tested individually in the mobile van during the actual experiment. The computer competition was explained, instructions for operating the maze were given, and two practice trials were allowed. Just before the competition began, pre-competition A-state was assessed with Spielberger's (1973) State-Anxiety Inventory for Children. During competition the win-loss ratio was manipulated according to the following schedule: individuals in the Wo condition won contests 1, 3, 5, 6, 9, 11, 13, 16, 18 and 20; individuals in the W_{50} condition won contests 1, 3, 7 and 15; and individuals in the W_{80} condition lost contests 2, 4, 7 and 15. After each contest the subject's time, the opponent's time and the winner of that contest were announced. After every fourth contest the cumulative win-loss total was announced. After all 20 games were completed individuals in the W_{50} and W_{20} condition were informed by a pre-typed computer print-out that they had inadvertently been matched against either a high school student or an opponent using an easier maze. This debriefing procedure was used to assure the Woo and W. subjects that they had performed well and to alleviate feelings of failure.

Results

The data were analyzed by two methods. First an analysis of variance of 2 X 3 X 2 (sports-anxiety test scores X success-failure X blocks of trials)2 X 3 X 2 (sports-anxiety test scores X success-failure X blocks of trials) was computed with a repeated observation as the last factor. The 20 contests were grouped into two blocks of 10 trials each. Subjects' average time to complete the maze and the variability of times within each block were the dependent variables. The second method, multiple regression analysis, was used to determine how well sports anxiety and success-failure predicted performance. In addition, this latter method permitted the inclusion of A-state scores in the regression equation.

Variance analysis—No main effect, sports anxiety and success-failure, or the interaction of these two factors approached statistical significance for either dependent variable. The main effect of blocks was significant for both the average performance time (F1,13 = 78.25, p < .001) and the variability of time ($F_{1,13}$ = 13.94, p < .01), using the conservative F test. This significant effect indicated that subjects decreased their performance time and performance variability from Block 1 to Block 2, suggesting that learning occurred. None of the within-subject interactions were significant for either dependent variable.

Multiple regression analysis.—For two reasons multiple regression analyses were computed on the time scores. First it provided a clear indication of the percent of variance that the independent variables predicted. Second the influence of competitive A-trait on motor performance is, according to theory, mediated by the level of A-state. That is, high competitive A-trait subjects manifest higher levels of A-state than low competitive A-trait subjects and it is these higher A-states that presumably interfere with performance of a novel, complex motor task.

The first multiple regression equation consisted of sports-anxiety scores and the success-failure as predictors and the mean time of each 10-trial block as criterion variables. Both F ratios were nonsignificant and the multiple correlation indicated that these two predictors could account for only 2% of the performance variance on Block 1 and 3% on Block 2. In search of a better prediction equation of performance on the motor maze the pre-competition A-state score was added as a predictor. Including this measure of arousal did not appreciably alter the results of the regression analyses. Both F ratios remained nonsignificant and only 3% of the performance variance was accounted for by these three predictors for both blocks.

One other possibility was explored. The inverted-U hypothesis predicts that the relationship between arousal and performance is curvilinear. The regression equation above determined if A-state was a reliable predictor of performance *using* a linear model. Another regression analysis was computed using a regression equation which determined if A-state was a reliable predictor of performance using a curvilinear model. The results of this analysis also failed to appreciably modify the previous regression results.

EXPERIMENT 2

Exp. 2 was a replication of Exp. 1 with some minor changes and one major addition. Sex was included as a factor in the design of Exp. 2. Little research has investigated how the relationship of A-trait and motor performance differs for males and females in competitive situations, but *research* by Horner (1974) suggests that females respond differently from males to achievement situations. She stares, "If anxiety about competitiveness and its aggressive overtones underlies the major differences detected in research on achievement-related motivation in women, then women should behave quite differently in competitive and noncompetitive achievement situations" (p. 98). Thus it seemed desirable to include both sexes in the experimental design. If indeed females are more anxious about competitive situations, it is plausible to expect those females who are high in competitive A-trait to be more adversely affected by the competitive conditions.

Method

The experimental design, apparatus, and procedures of Exp. 2 were much the *same as* in Exp. 1. The initial sample of 490 fifth and sixth grade students included both sexes and equal numbers of boys and girls from the high (24-30) and low (10-16) extremes of the sports-anxiety distribution were selected for the experiment (n = 96) . A fourth noncompetition control condition *was* added to the three success-failure conditions of Exp. 1 resulting in a 2 X 2 Xadded to the three success-failure conditions of Exp. 1 resulting in a 2 X 2 X 4 X 2 repeated-measures factorial design (sex X sports anxiety X success- failure X blocks of trials) for Exp. 2.

The maze and computer apparatus were identical to those of Exp. 1. Similar instructions were given and one practice trial was allowed prior to the competition. The win-loss ratio was manipulated as in Exp. 1 for the three conditions of success and failure, but competition was not mentioned and only the subject's own time was announced for individuals in the noncompetitive control condition. In addition to the pre-competition A-state measure a second SAIC was administered during a short break between the 10th and 11th games (midcompetition) . Al! other procedures were identical to those of Exp. 1 except that the special debriefing was used only with the W_{20} subjects.

Results

Variance analysis.—Sex was significant ($F_{1,80}$ = 6.32, *p (* .01) for the mean time of males completing the maze was quicker *(M* = 40.9 sec.) than that of the females *(M* = 46.5 sec.) . Males also tended to be less variable in their performances *(M* = 131.0) than females *(M* = 191.9), although this difference was only marginally significant (F1,80 = 3.78, $p < .06$). The main effects of sports-anxiety scores and success-failure were not significant for either dependent variable. None of the two-factor interactions were significant, although the interaction of sex X sports anxiety for mean time approached sigal though the interaction of sex X sports anxiety for mean time approached significance (F1,80 = 3.69, $p < .06$). The interaction of sex X sports anxiety X success-failure, which was significant for mean time ($F_{3,80}$ = 2.86,p < .04) and variability of times (F3,80 = 2.79, $p < .05$), is illustrated in Figs. 1 and 2.

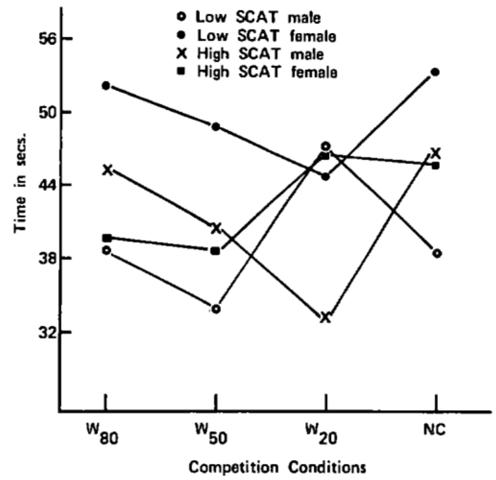

FIG. 1. Interaction of sex × sports anxiety × success-failure for mean performance times

The main effect of blocks *was* significant using the conservative *F* test, indicating that all subjects improved in their performance by reducing their mean performance time (F1,5 = 359.93, $p < .001$) and variability of performance (F1,0 = 56.17, $p < .01$) from Block 1 to Block 2. None of the other within-subject tests were significant for either dependent variable.

The triple interaction suggests that the sex and competitive A-trait level of the subject interact with success-failure in a complex way to influence performance. Because of the small sample size *(n* = 6) in each cell of this interaction and because of the low statistical power of the *F* ratio, *post hoc* tests were not considered useful in interpreting this interaction. Additional insight into the relationship between these three factors and performance is obtained from the multiple regression analyses.

Multiple regression analyses.—These analyses were computed with sex, sports anxiety, and success-failure as predictors and performance times for each

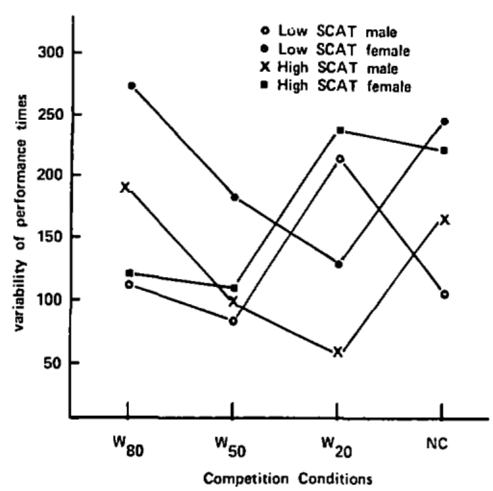

FIG. 2. Sex × sports anxiety × success-failure interaction for mean variability in performance

block of trials as dependent variables. Two other multiple regression analyses were computed wherein the A-state score obtained just prior to the performance of the 10 contests was added as a predictor to the *regression* equation. In these regression analyses the noncompetition control groups were eliminated because this condition could not be logically coded with the three success-failure conditions.

The first multiple regression using the three independent variables, and the Astate scores, produced a significant F value for Block 1 ($F_{3,68} = 3.39$, $< .05$) but not for Block 2 ($F_{3,68} = 1.90$, $p > .05$). The three predictors in Block 1 yielded a multiple R of $.36$, i.e., they accounted for only *13%* of the performance variance. The t test of the regression coefficients indicated that almost all of this variance was attributable to sex ($t_{62} = 3.02$, $< .01$).

The second regression equation added the Astate pre-competition score to the predictors with Block 1 performance times being the criterion. This same analysis was done with Block 2, but the A-state score was the mid-competition score. The multiple regression for Block 1 was marginally significant ($F_{187} = 2.51$, p (.06). The multiple R was $.36$, indicating that the total variance accounted for by the addition of the A-state scores to the regression equation was unchanged. Again the t test showed that almost all the variance accounted for was attributable to sex ($t_{ß,7} = 2.97$, $p < .01$) . The multiple regression on Block 2 was nonsignificant with Astate scores not affecting the prediction of performance scores appreciably.

These last two regression analyses were repeated with the regression equation modified to examine the curvilinear relationship between Astate and performance. In both cases the results were nonsignificant and the percent of variance explained remained unchanged.

DISCUSSION

Neither competitive A-trait nor success-failure separately or interactively affected motor performance in either experiment. A complex interaction of sex X sports anxiety sex X sports anxiety X success-failure for performance time and performance variability was obtained in Exp. 2. Inspection of Fig. 1 indicates that males low on sports anxiety were adversely affected by the failure treatment but high scoring males performed best in this condition. High scoring females performed better in the $_{W80}$ and $W5_0$ conditions but not nearly as well in the $W_{,0}$ and noncompetitive conditions. Females low in sports anxiety performed poorly in all conditions, although their best performance was in the W20 condition, Nearly the same pattern of results was obtained for the variability of performance dependent variable shown in Fig. 2. The importance of this interaction was somewhat diminished, however, when it was shown through multiple regression that the three factors of this interaction accounted for only 13% of the performance variance and that almost all of this variance was attributable to the sex of the performer.

The approach taken in discussing these results is that statistically nonsignificant results may be of considerable practical and theoretical significance. Special emphasis will be directed toward discerning *why* these results were nonsignificant. In these two experiments the relationship between the independent and dependent variables was hypothesized to be mediated by variations in Astate. As reported by Scanlan for Exp. 1 and by Martens and Gill (in press) for Exp. 2 both main effects of competitive A-trait and success-failure led to reliable differences in A-state as predicted. High competitive A-trait persons manifested higher A-state levels than low competitive A-trait persons and failure increased A-state levels while success decreased A-state levels. In other words, the results for these main effects supported the relationship between the treatments and A-state, but the results reported here did not support the hypothesized relationship between A-state and performance. The multiple regression analyses did not support either an hypothesis based on drive theory, which predicts a positive linear relationship between arousal and performance, or the inverted-U hypothesis which predicts a curvilinear relationship.

The interaction of competitive A-trait X success-failure was not significant. The interaction of competitive A-trait X success-failure was not significant for the A-state scores in either experiment. Thus it is not surprising that the interaction between competitive A-trait and success-failure for the performance scores was nonsignificant in Exp. 1. Although there was a three-way interaction between these two variables and sex in Exp. 2, the pattern of this interaction was dominated by sex and does not approximate the predicted interaction between competitive A-trait and success-failure.

Ironically, in Exp. 2 no differences in A-state levels were recorded as a function of sex. Sex was, however, the only factor significantly related to performance in this experiment, suggesting that A-state or arousal may not be a necessary mediator of motor performance.

Accumulated evidence from the literature indicates that the reported relationship between arousal and motor performance has never been very strong (Martens, 1974). That is, when statistically significant results have been obtained the arousal-manipulating variable has not accounted for a large percent of the performance variance. When the unpublished literature is combined with the published literature, the accumulated evidence is even less optimistic about the strength of the arousal-performance relationship. Perhaps the major shortcoming in many studies examining the relationship between arousal and performance is that arousal is measured discretely and not continuously. Knowing that the person is highly aroused just prior to competition may not be indicative of his arousal level when he actually performs during the competitive event. The longer the interval between the measurement of arousal and the performance, the greater the likelihood that the single discrete measure is inadequate. Another major obstacle to research in this area is the lack of an adequate understanding of the arousal mechanisms and methods for assessing arousal. Before much progress is likely to be made in the measurement of arousal, better understanding of arousal mechanisms must be gained. A third obstacle to understanding the arousal-motor performance relationship is the crude measurement of motor performance.

At present, given the evidence at hand, indications are that arousal is not a strong determinant of performance. The equivocality of the arousal-motor performance literature may in part be explained by methodological problems, by individual and task differences, and by differences in the sensitivity of the experiments. While most investigators have attributed the weak and inconsistent arousal-motor performance relationship to these problems, it just may be that arousal is not a powerful determinant of motor performance. The tenacity with which researchers have pursued the arousal-performance relationship indicates that the latter explanation is typically rejected but the accumulated evidence, including the current results, suggests this explanation is increasing in plausibility.

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